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Accident Detection and Alert System for Medical Assistance

Madhuri Emmidi[1]

Gaurav Sharma[2*]

[1]*M.Tech Scholar, ECE Dept.,CVR College of Engineering, Hyderabad*
madhuriemmidi16@gmail.com

[2]*Faculty of ECE Dept., CVR College of Engineering, Hyderabad*
ergaurav209@yahoo.co.in

**Corresponding author*

Abstract: *Now-a-days, major parts of the accident are due to the uneven interruptions. Speed is one of the reasons for most of vehicle accidents. Hope this project will provide the solution for this drawback. If emergency services get the accident information in time, then many lives could have been saved. If a vehicle meets with an accidents accelerometer detect the signal and sent it to the ARM controller. The project is helpful in detecting the accident and alerting the near-by help center by tracking the geographic location and checking the condition of the person. In future, we can enhance the project by capturing the accident images.*

Keywords: *Accident detection, Alert Mechanism, ARM Controller, Medical Assistance, Health Monitoring*

I. INTRODUCTION

According to the survey in 2017, approximately the total of 2,076 people died in road accidents. The demand of the automobiles has increased the road accidents. Due to the lack of emergency facilities in our country, we are introducing the automatic alert device for vehicle accidents. The proposed system detects the accident and sends the information inless time to near-by first aid center. The uncontrolled event of a person results in personal injury. The highest percentage of all deaths due to road traffic accidents.It not only affects the crash but also increases the risk involved in it .With this project, an app is created along with the hardware components so that the information is transferred to the near-by police station or ambulance.

An IOT (Internet of Things) is the network of the physical device, vehicles and other items embedded with electronics, software, sensors, actuators and network connectivity which help in connectivity of data. IOT refers to rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. It is used for monitoring events and changedin structural conditions which compresses of risk and scheduling repair and maintenance activity in efficient manner.

Accident detection and alert system has been extensively studied over the past several years. Research work in this field has proposed a Telematics model which has three main modules [1]. The system is intended to capture the location of the vehicle through GPS receiver, send the location information to vehicle owner's mobile number through SMS and also to the telematics operator server through GPRS. Another prototype proposes a system to detect and provide faster assistance to traffic accident victims [2]. A prototype architecture to improve the chances of survival for passengers involved in car accidents has also been proposed [3]. The proposed system offers automated detection, reports, and assistance to passengers involved in road accidents by exploiting the capabilities offered by vehicle to vehicle communication technologies. Here a low cost alert system is proposed to provide immediate medical aid to the accident victims by alerting the nearby medical assistance center with the exact place of accident and the details of the patient through SMS. This system also takes the medical condition of the accident victim by checking the heartbeat to understand the seriousness of the accident and inform the medical aid center.

II. RELATED WORK

Many researchers have tried to develop an IoT based system that will automatically detect road accidents.Patel [1], in his paper, developed an android system that can detect vehicular accidents using only the accelerometer. This cannot give sufficient data or information to know about the severity of the accident and whether it requires any urgent medical assistance. In above paper, the question about reliability and effectiveness arisesas only one sensor is used for detecting accidents. Thompson C. [2] and K. Patel [3] haveproposed systems that use sensors in the smartphone to detect accidents. The smartphone uses the cellular internet connection to detect the accidents and send the signal information. Another approach by A. Zainab [4] was to make the emergency notification system from smartphones without any remote server.The major drawback of the system is that it is technologically outdated as it is not fully automated, and one must manually send the data tothe desired receiving ends, which delays the process. Furthermore, privacy is a concern in anything connected to internet.In the era of innovation and IoT, these systems are relatively less efficient in solving the issue of accident detection as they take longer to process data and are therefore not time efficient. Another paper by H. Kim [5] has elaborated on the use of unmanned aerial vehicles(UAVs) or drones for monitoringsmart cities and rapid emergent disaster detection and report.

Butthis might result in the possibility of collision as multiple drones could be moving at the same time. However, Kim and Ben-Othman proposes a collision-free surveillance system using smart UAVs in multi domain IoT.

Accident Detection Depending on the Vehicle Position and Vehicle Theft Tracking, Reporting Systems [5], here the researcher introduces a new system with different algorithm that sense the accidents with the help of accelerometer sensor's tilt direction and other various hardware like GSM modem and GPS. The researches have also developed an android application which will display the accident location in case it happens. The vital components on which the system is solely dependent are the 3-axis accelerometer sensor and GSM modem, which can be replaced with a single device i.e. 'Smartphone' as it comes with the entire mentioned sensor above pre-built in it. In addition to this system uses GSM modem, which can create a delay while sending the emergency message to the user as it is a queue based technique. Beside that the maintenance of the hardware system is quite expensive.

Car Accident Notification System based on Internet of Things [10]; here the researchers introduce an emergency call notification system using Internet of Things and Cloud computing. The researches have implemented the proposed system using XBee Wi-Fi module, XBee Shield, GPS module, Seeeduino and crash sensors. The basic idea is to detect the accident with the help of crash sensor and trace the exact co-ordinates of the accident spot via cloud using XBee Wi-Fi to the nearest hospital. The main aim was to propose a system allowing global interconnect with the Internet of Thing and Cloud. Despite the limitation the system is a step forward in the field of Internet of Things and with the help of Cloud the information can be transmitted to a long distance. Furthermore the system can be improvised by programming the system to immediately notify the family members of the victim.

Utilizing the Emergence of Android Smartphone for Public Welfare by providing Advance Accident Detection and Remedy by 108 Ambulance [4] here they have developed an android application that is used to identify the accident using variation in acceleration parameters. After detecting the accident application spontaneously generates the topographical information by GPS and send pre-recorded voice message to emergency response service. The crucial theory behind the working of this application is that the mobile phone should not be kept with the driver who is driving the car. It must be attached inside the vehicle. The biggest shortcoming or the loophole in this system is that the phone may tilt or fall inside the vehicle accidently without having a real time accident thus generating false positives.

III. PROPOSED WORK

An initialization procedure is suggested to generate a finite set of potential spots where theUAVs will be able to undergo collision-free movements. Using UAVs can be an issue in

countries such as Bangladesh, where special permission is required to legally operate them in air.

The proposed system in deals with an automatic accident detection system involving vehicles which sends information about the accident including the location, the time and angle of the accident to a rescue emergency unit is provided. This information is sent in the form of an alert message. A GSM module is used to send the alert message and a GPS module is used to detect the location of the accident. The GPS and GSM module are interfaced to the control unit using serial communication. The accident itself is detected using two sensors- Micro Electro Mechanical System (MEMS) sensor and vibration sensor. MEMS sensor also helps in measuring the angle of roll over of the car. A 32-bit ARM controller is used as the main high speed data-processing unit. The vibrations are sent from the vibrating sensor to the controller after passing through an amplifying circuit. Similarly the roll over angle is sent from the MEMS sensor to the controller.

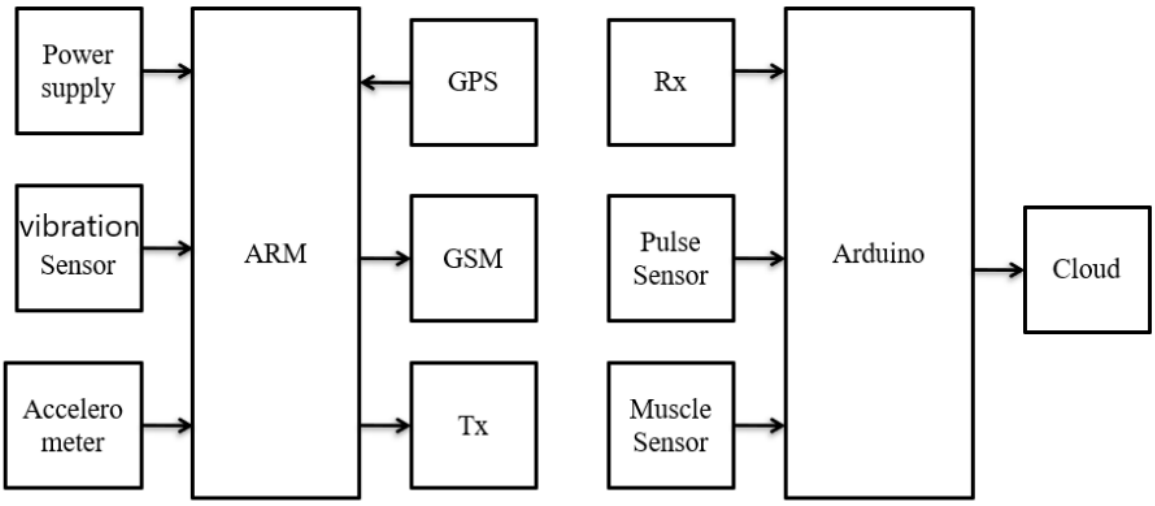

Fig. 1 Accident detection and Health Monitoring Unit

The purpose is to contribute to the existing work to enhance the quality of the overall framework so that it can benefit the end society in future. This can be achieved by adding more functionalities and features that can improve the working of the end system. In our approach, we are addressing the gaps by adding an accelerometer, vibration sensor and most importantly heart rate sensor. These components contribute to the hardware setup of the system [8]. Also, we would like to introduce an algorithm for general road accidents that is appropriate for this hardware setup. We have considered a few parameters which are helpful for accident detection and notification. These parameters are vehicle acceleration, retardation, and crash impact, the value of heart rate sensor (embedded within the belt) and information of accident location which is tracked by GPS as shown in

Fig. 1 as block diagram. It is then sent to emergency services/family members by GSM communication.

The system is implemented by designing an IOT based car. The car is embedded in Arduino as a development board which is interfaced with different sensors as listed above. It is controlled via Bluetooth module HC05. Also, the car is tested for different conditions to seek results. For this setup, the algorithm operates on the data gathered by accelerometer ADXL345, vibration sensor, heartrate sensor, GPS and GSM module. These sensors have their configurations and threshold range. The accelerometer's input range can be 2g to 200g (negative and positive) and it can vary even more. Whereas, the vibration sensor has only two states, low and high. It is low for normal cases. On experiencing a large impact force from the environment, it becomes high [11]. The heart rate sensor is the essential component since it keeps track of the driver's heart beats during the journey. Normally, the heart rate for a person is between 75-170 bpm for the group of people between 20 and 50 years. The various components used in the project are described below:

A. ARM Controller

ARM Controller ARM (stylised in lowercase as arm, previously an acronym for Advanced RISC Machines and originally Acorn RISC Machine) is a family of reduced instruction set computing (RISC) architectures for computer processors, configured for various environments.

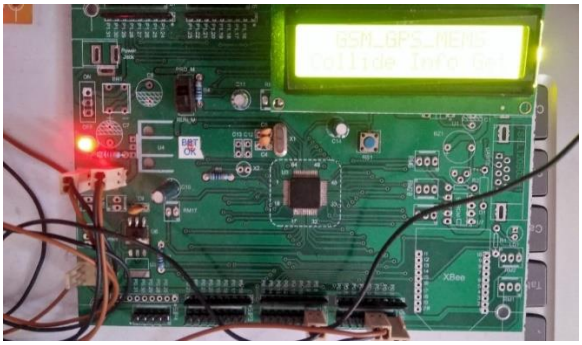

Fig.2ARM controller

ARM Ltd. develops the architecture and licenses it to other companies, who design their own products that implement one of those architectures—including systems-on-chips (SoC) and systems-on-modules (SoM) that incorporate different components such as memory, interfaces, and radios. It also designs cores that implement this instruction set and licenses these designs to a number of companies that incorporate those core designs into their own products.

B.Accelerometer

An accelerometer works by detecting proper acceleration affecting the accelerometer to determine the G-forces affecting the accelerometer [7]. Proper acceleration means acceleration that is relative to free-fall [9]. An object in free-fall would as such have no acceleration affecting it while an object at rest on the surface of the earth would experience an acceleration of 9,81 m/s2 upwards due to the surface pushing the object upwards to negate gravity. Accelerometers in smartphones bases their functionality on micro-electromechanical-systems (MEMS), which measure electric currents based on compression of a seismic mass, often silicon, caused by acceleration.

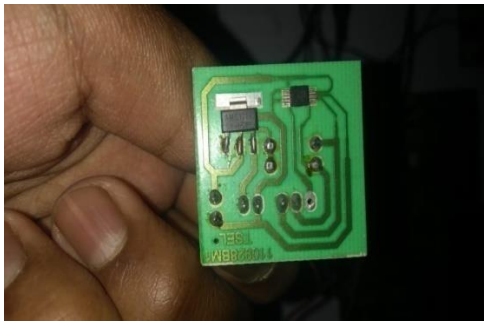

Fig.3Accelerometer

C. Bluetooth

HM-06 is a Bluetooth module designed for establishing short range wireless data communication between two microcontrollers or systems. The module works on Bluetooth 2.0 communication protocol and it can only act as a slave device.

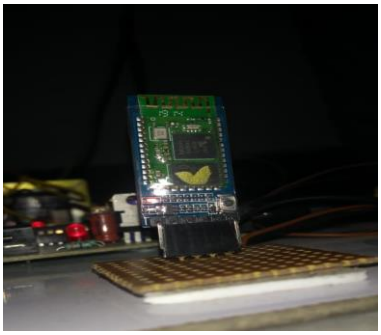

Fig.4Bluetooth

This is cheapest method for wireless data transmission and more flexible compared to other methods and it even can transmit files at speed up to 2.1Mb/s.HC-06 uses frequency hopping spread spectrum technique (FHSS) to avoid interference with other devices and to have full duplex transmission. The device works on the frequency range from 2.402 GHz to 2.480GHz.

D. GPS Module

The NEO-6M module includes one configurable UART interface for serial communication, but the default UART (TTL) baud rate here is 9,600. Because the GPS signal is right-hand circular-polarized (RHCP), the style of the GPS antenna will be different from the common whip antennas used for linear polarized signals. The most popular antenna type is the patch antenna [12, 14, 15].

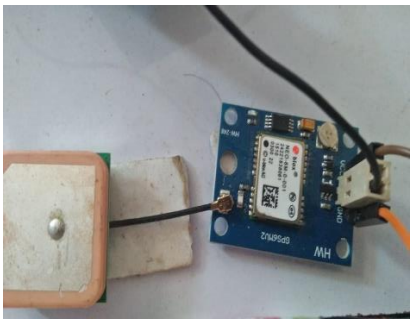

Fig.5GPS Module

E.GSM Module

SIM800L GSM/GPRS module is a miniature GSM modem, which can be integrated into a great number of IoT projects. All the necessary data pins of SIM800L GSM chip are broken out to a 0.1″ pitch headers.

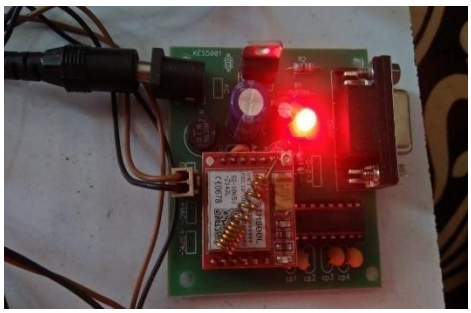

Fig.6 GSM Module

This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 1200bps to 115200bps with Auto-Baud detection [9, 11, 12].

The module needs an external antenna to connect to a network. The module usually comes with a Helical Antenna and solders directly to NET pin on PCB. The board also has a U.FL connector facility in case you want to keep the antenna away from the board.

F. Muscle Sensor

This sensor will measure the filtered and rectified electrical activity of a muscle; outputting 0-Vs Volts depending the amount of activity in the selected muscle, where Vs signifies the voltage of the power source. Power supply voltage: min. +-3.5V. By detecting the electromyogram (EMG), measuring muscle activity has traditionally been used in medical research, however with shrinking but more powerful microcontrollers and integrated circuits advent EMG power Road and sensors can be used for various control systems.

This Muscle Sensor v3 measures, filters, rectifies, and amplifies the electrical activity of a muscle and produces an analogue output signal that can easily be read by a microcontroller, enabling novel, muscle-controlled interfaces for your projects.

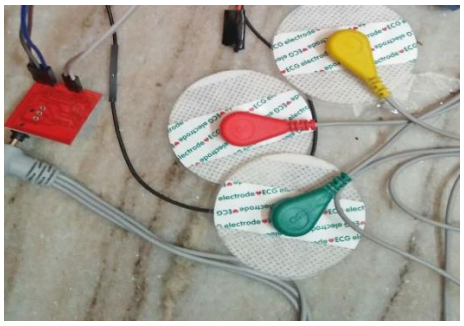

Fig.7 Muscle Sensor

G. Heartbeat Sensor

Heartbeat sensor consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulses cause a variation in the flow of blood to different regions of the body [13]. When tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in the form of the electrical signal and is proportional to the heartbeat rate.

Fig.8 HeartbeatSensor

H. Vibration Sensor

This Vibration Sensor Module consists of an SW-420 Vibration Sensor, resistors, capacitor, potentiometer, comparator LM393 IC, Power, and status LED in an integrated circuit. The vibration sensor module based on the vibration sensor SW-420 and Comparator LM393 is used to detect vibrations [11]. The threshold can adjust using an on-board potentiometer. During no vibration, the sensor provides Logic Low and when the vibration is detected, the sensor provides Logic High.

IV. RESULT ANALYSIS

The suggested system here alerts and detects the occurrence of accident and forwards the information to the registered number. This is done after mere attempts. In worst conditions, soon after the accident occurs, the vibration sensor is activated and transfers the message. The GPS finds the location where accident happened and the GSM sends the message. If any accident occurs, the module sends data of information to the given number. These are found after several trails and it worked out well. These can be applied in all network available areas. These helps in giving the medical treatment as soon as the accident occurred as the location can be found easily.

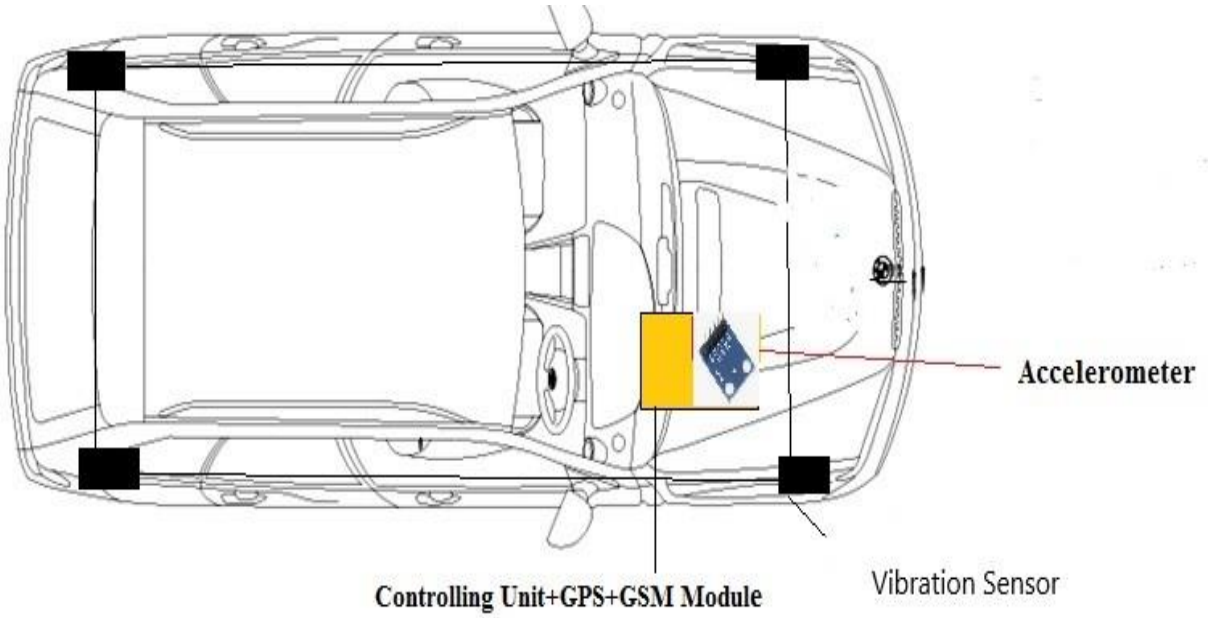

Fig. 9 Placement of Sensor

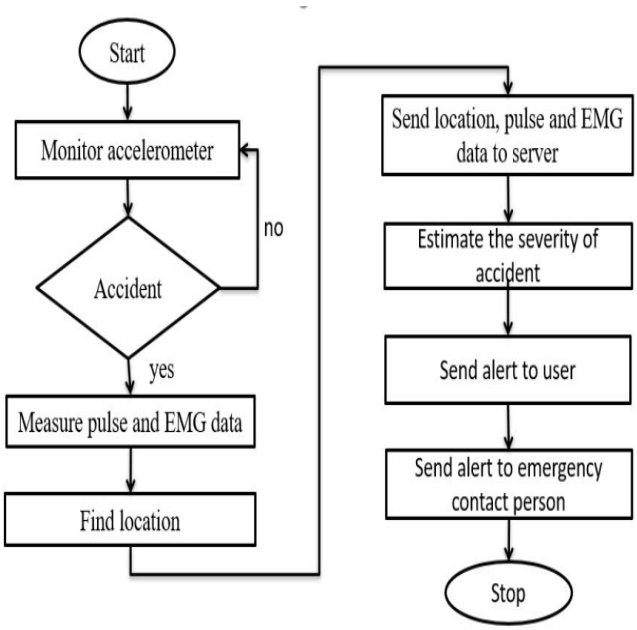

Fig. 10 Flow Chart

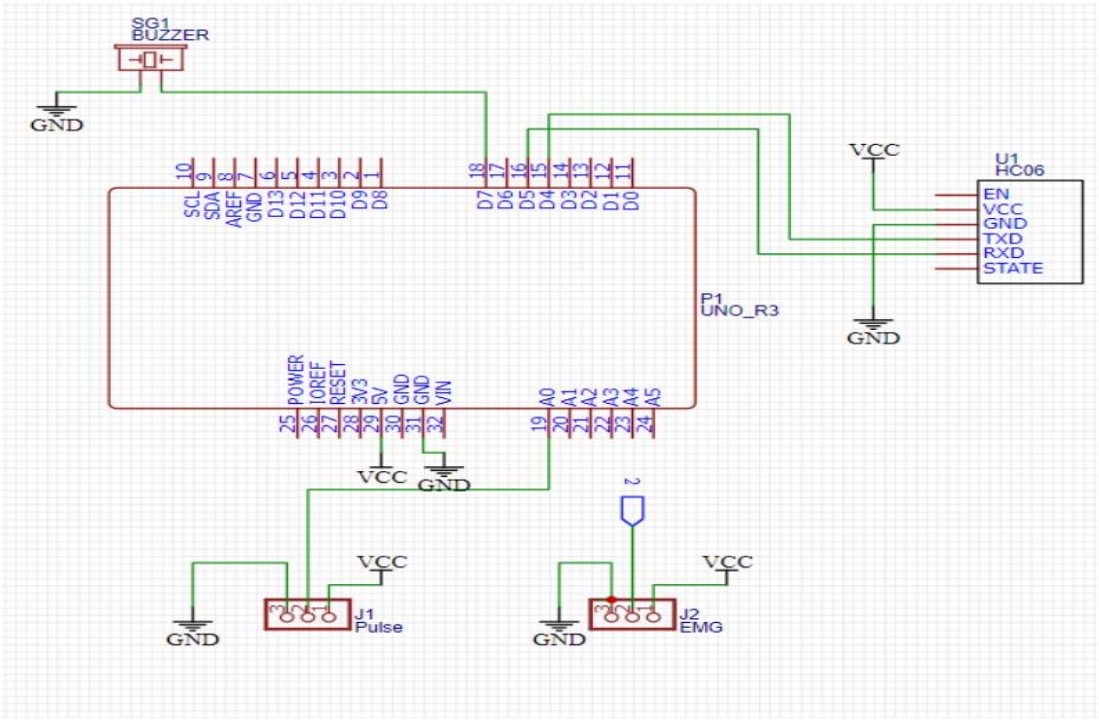

Fig. 11 Health monitoring unit circuit design

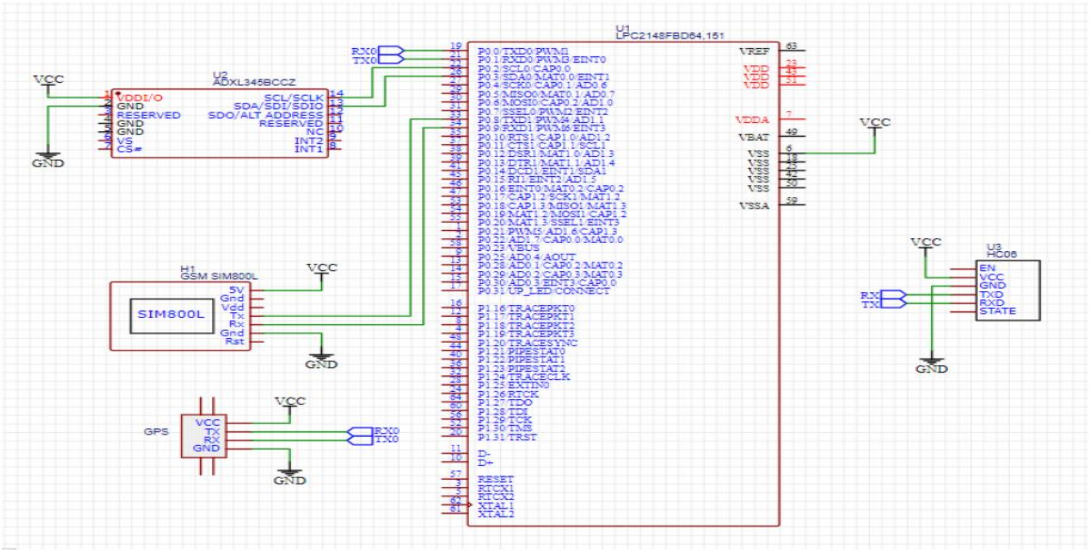

Fig. 12 Accident detectionunit circuit design

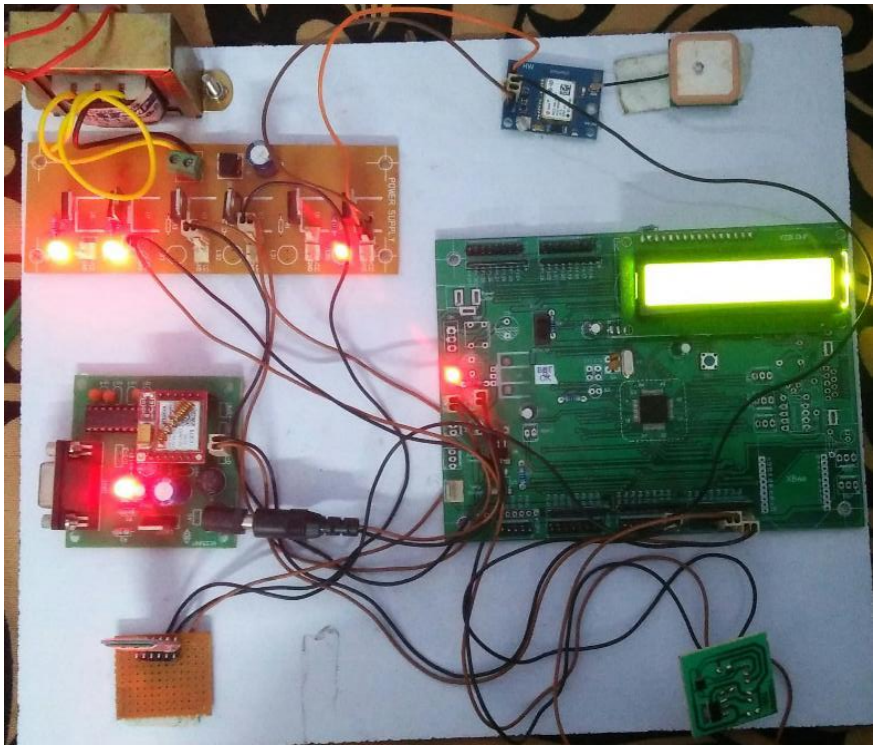

Fig. 13 Accident detection unit hardware

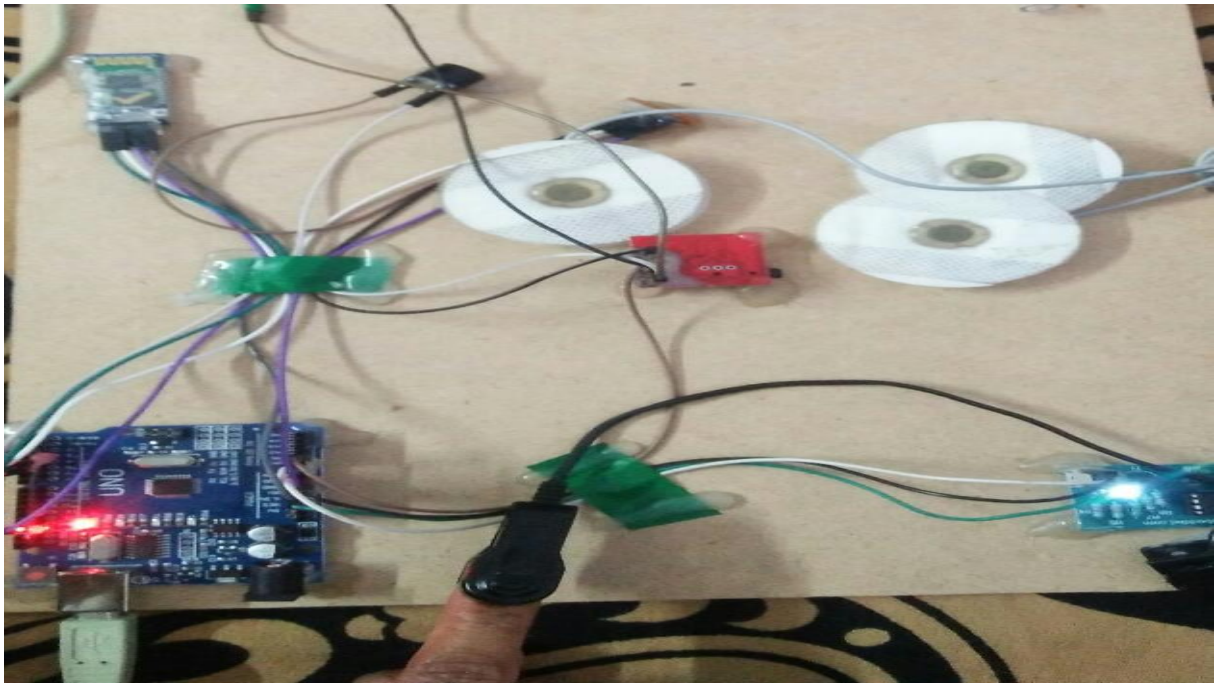

Fig. 14Healthmonitoring unit Hardware

Fig. 15 Output Displayed on LCD

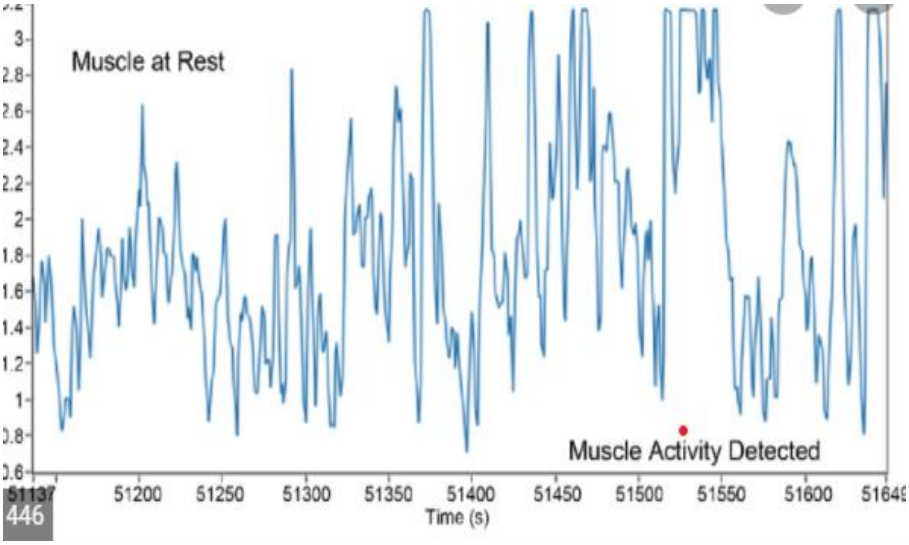

Fig. 16 Simulation output of Muscle sensor

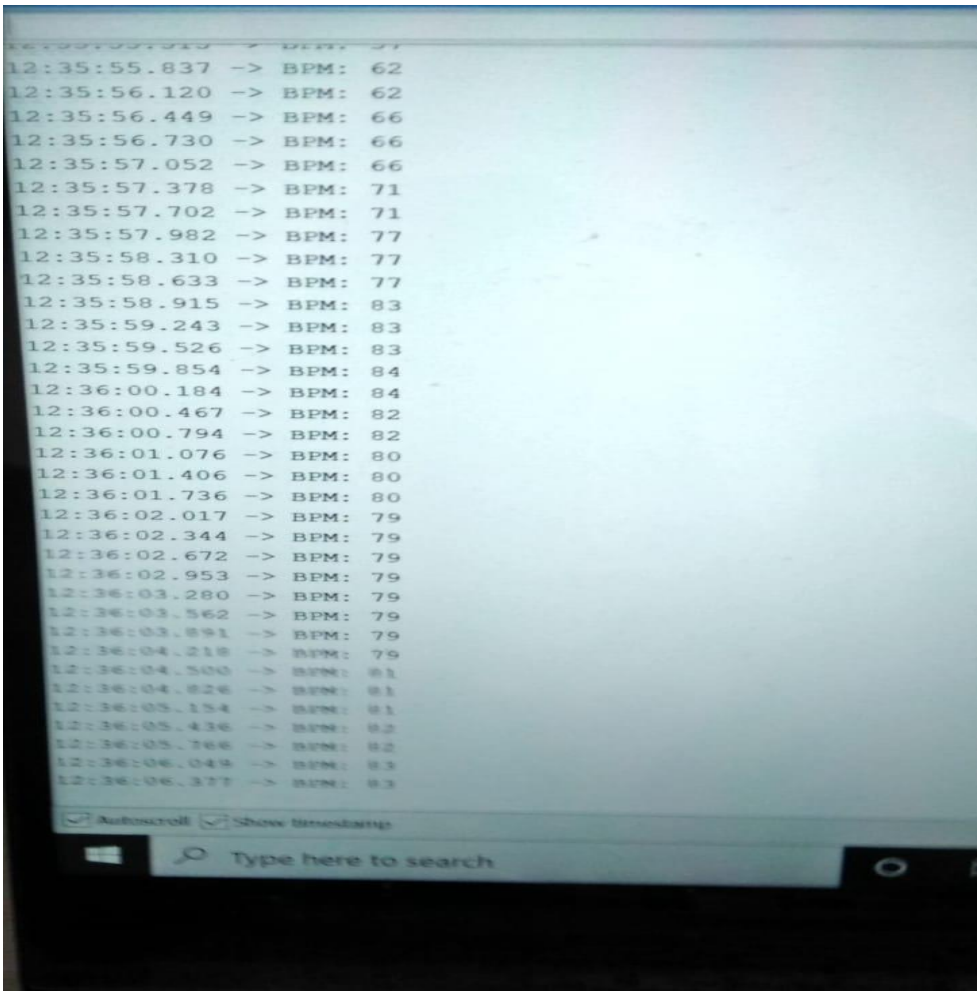

Fig. 17Simulation output of Heartbeat sensor

V. CONCLUSION

Vehicle tracking system makes better fleet management and which in turn brings large profits. Better scheduling or route planning can enable you handle larger jobs loads within a particular time. Vehicle tracking both in case of personal as well as business purpose improves safety and security, communication medium, performance monitoring and increases productivity. So in the coming year, it is going to play a major role in our day-to-day living.

Main motto of the accident alert system project is to decrease the chances of losing life in such accident which we can't stop from occurring. Whenever accident is alerted the paramedics are reached to the particular location to increase the chances of life. This device invention is much more useful for the accidents occurred in deserted places and midnights. This vehicle tracking and accident alert feature plays much more important role in day to day life in future.

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